# Facies and petrochemical characteristics of the Tertiary aged Tekkeköy (Samsun) area volcanics, NE Turkey

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Tertiary volcanics crops out widespreadly in the eastern Pontide, NE Turkey. Of these, the Tekkeköy (Samsun) area volcanics in a E-W trending shallow marine basin lie along the Black Sea coast in the western part of the Eastern Pontide Tertiary Volcanic Province (EPTVP) [1]. The volcanic facieses are dominantly basaltic pyroclastics, less basaltic lava flows, dykes and trachytic dome. The basaltic rocks contain plagioclase, augite and rare olivine with porphyric, microlitic porphyritic, intergranular and locally cumulophyric textures. Trachytic rocks are composed of plagioclase, sanidine, hornblende and biotite with trachytic texture.

Petrochemically, the volcanics can be classified as basalt, trachybasalt, basaltic-andesite, basaltic trachyandesite and trachyte, and exhibit mildly alkaline to subalkaline with medium- to high-K in character. Major oxides and trace elements versus $SiO_2$ variations show negative correlation for $Al_2O_3$, $Fe_2O_3$*, CaO, $TiO_2$, $P_2O_5$, MnO, MgO, Co and V whereas positive correlation for $K_2O$, $Na_2O$, Rb, Ba and Zr, most of which can be explained by fractionation of cpx+Fe-Ti oxide in mafic rocks, and hornblende +apatite+Fe-Ti oxide in felsic rocks. Besides increase in U and Th with increasing $SiO_2$ from mafic to felsic rocks may be regarded to small amount of crustal assimilation. N–MORB normalized trace elements patterns show enrichment in LILE (Sr, K, Rb, Ba) and depletion in HFSE (Th, Ce, Zr, Ti, Y) with negative Ta-Nb anomaly, suggesting a subduction and/or crustal contamination signature The chondrite–normalized REE patterns of mafic to felsic samples are similar to each other revealing a common parental source magma (s) for the volcanics. The REE patterns have also concave in shape with marked light REE enrichment and heavy REE depletion, implying effect of significant cpx and hornblende controlled fractionation during the evolution of the volcanics. Facies and petrochemical features of the Tekkeköy volcanics suggest that they may evolved from parental magma (s) derived from an enriched lithospheric mantle source, and correlate others of collisional-post collisional volcanics in the EPTVP.

[1] Arslan, M. (2003) *Geology and Mining Potential of Eastern Black Sea Region Symp. Proc., Trabzon,* 103-105.

# B-bearing fluids: Caught in the act

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Fluid flow in the Earth's crust can be tracked, in part, by minerals that require a fluid-mobile element for formation. Tourmaline is nature's boron recorder. In many metamorphic systems, tourmaline growth reflects availability of boron-bearing fluids to the rocks. Such fluids can be internally derived, primarily from the progressive release of B during metamorphic breakdown reactions e.g., clays and micas. Alternatively, B-bearing fluids can be externally derived and infiltrate the metamorphic rocks e.g., from an associated pluton, if there exist sufficient chemical gradients, porosity and permeability.

During metamorphism, tourmaline (tur) formation records both types of fluid involvement. For example, internal fluids carrying B are marked by discrete stages of tourmaline growth, typically as overgrowths on a detrital tur core. Progressive growth zones are marked by distinct changes in mineral chemistry and decreases in compositional variability at the *+c* and *-c* axes. Externally derived fluids may be recognized by development of tourmaline-rich zones adjacent to igneous intrusions. In contrast, B infiltration may leave a more subtle trace such as the development of tourmaline-rich muscovite pseudomorphs after staurolite. Here tur records the infiltration of B-bearing magmatic fluids during high-grade metamorphism. Irreversible mineral-texture modeling combined with thermodynamic properties of the aqueous ions suggest that infiltration develops near the peak of contact metamorphism after sillimanite begins to form.

Computational heat and mass transport modeling of fluid evolution from a crystallizing pluton approximates timing as well as the timescales over which infiltration likely occurs during prograde metamorphism. For a 30km by 3km sheet-like granitoid intruded into host rocks with sufficient permeability to allow fluid flow, peak temperatures occur in about 500ky. By this time, host rocks have largely dehydrated, fluid pressures are insufficient to fracture the rock and provide pathways for flow, and the pluton has largely crystallized and released its fluid. Consequently, tourmaline growth and B movement must occur within this time frame. Tourmaline growth and dissolution provide a powerful signature of B cycling and transfer via fluids in the crust.